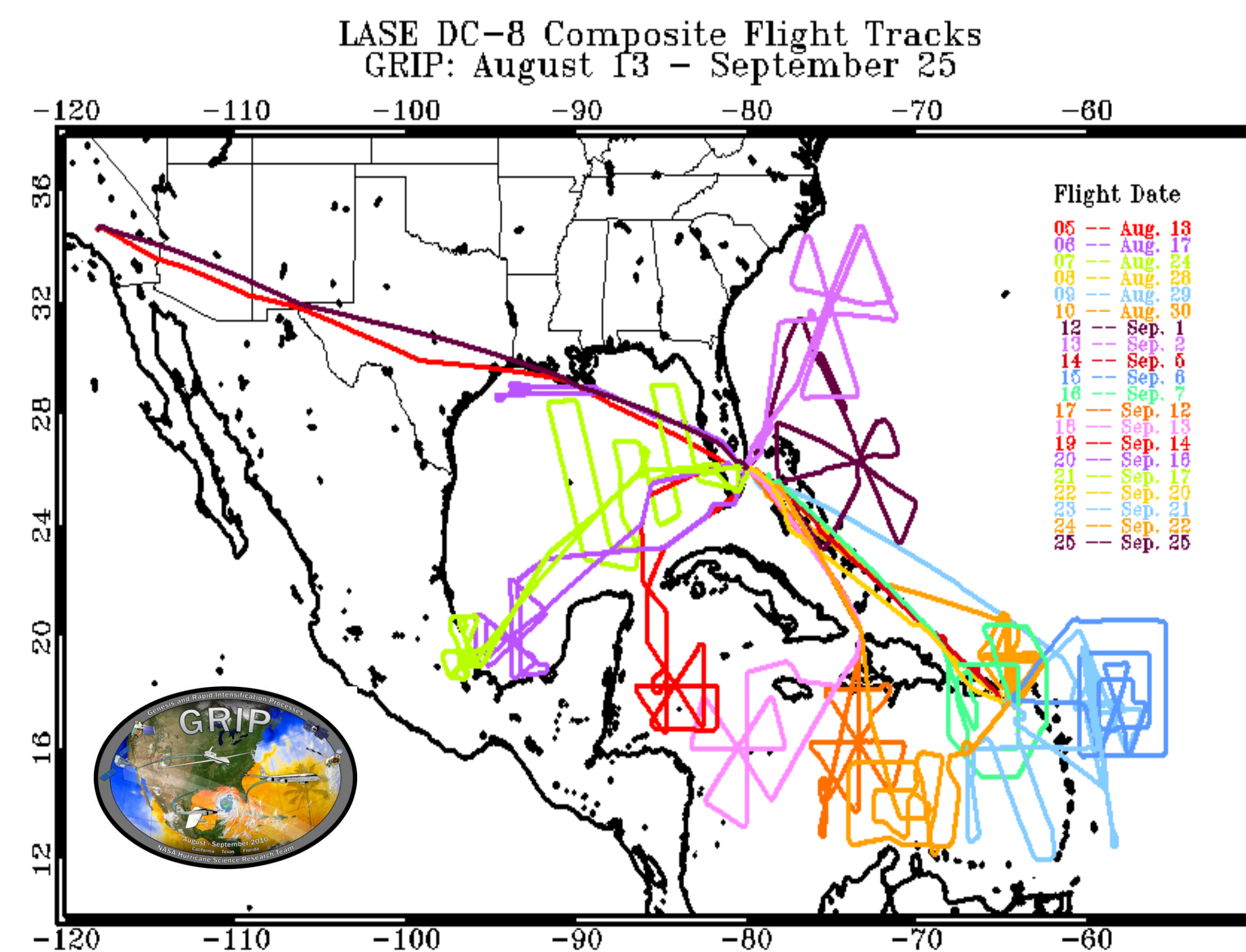
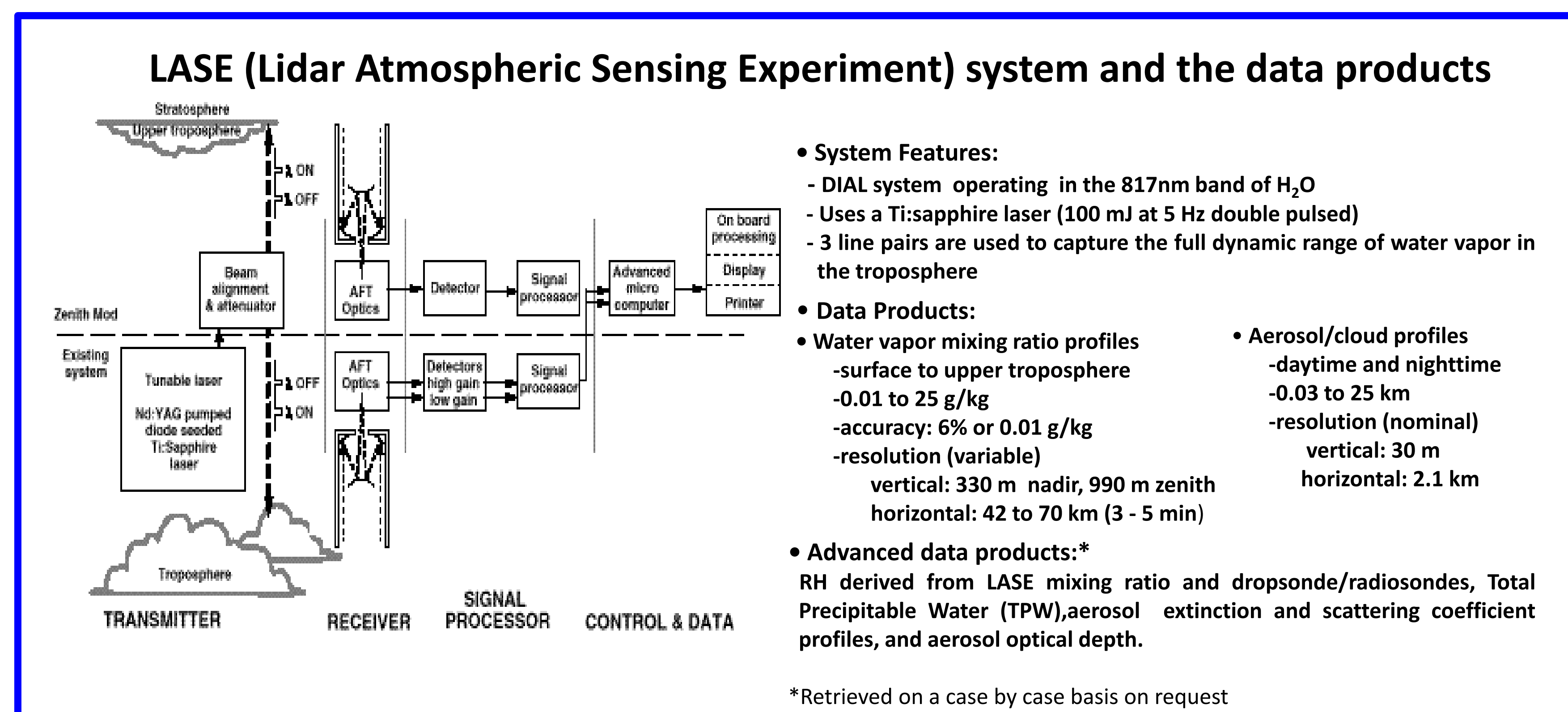


# LASE measurements of water vapor and aerosol profiles and cloud distributions during GRIP

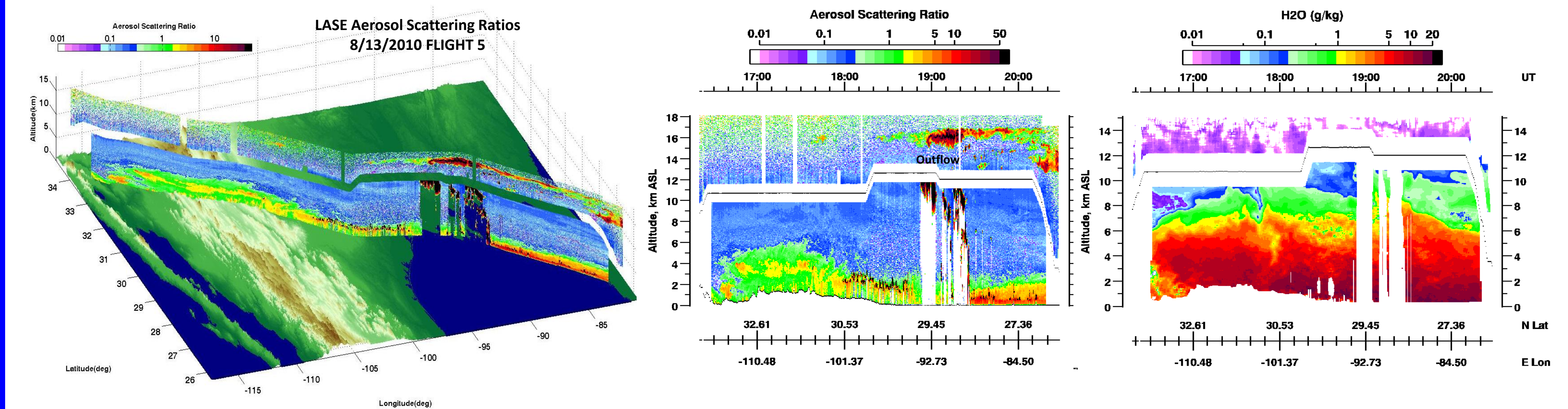
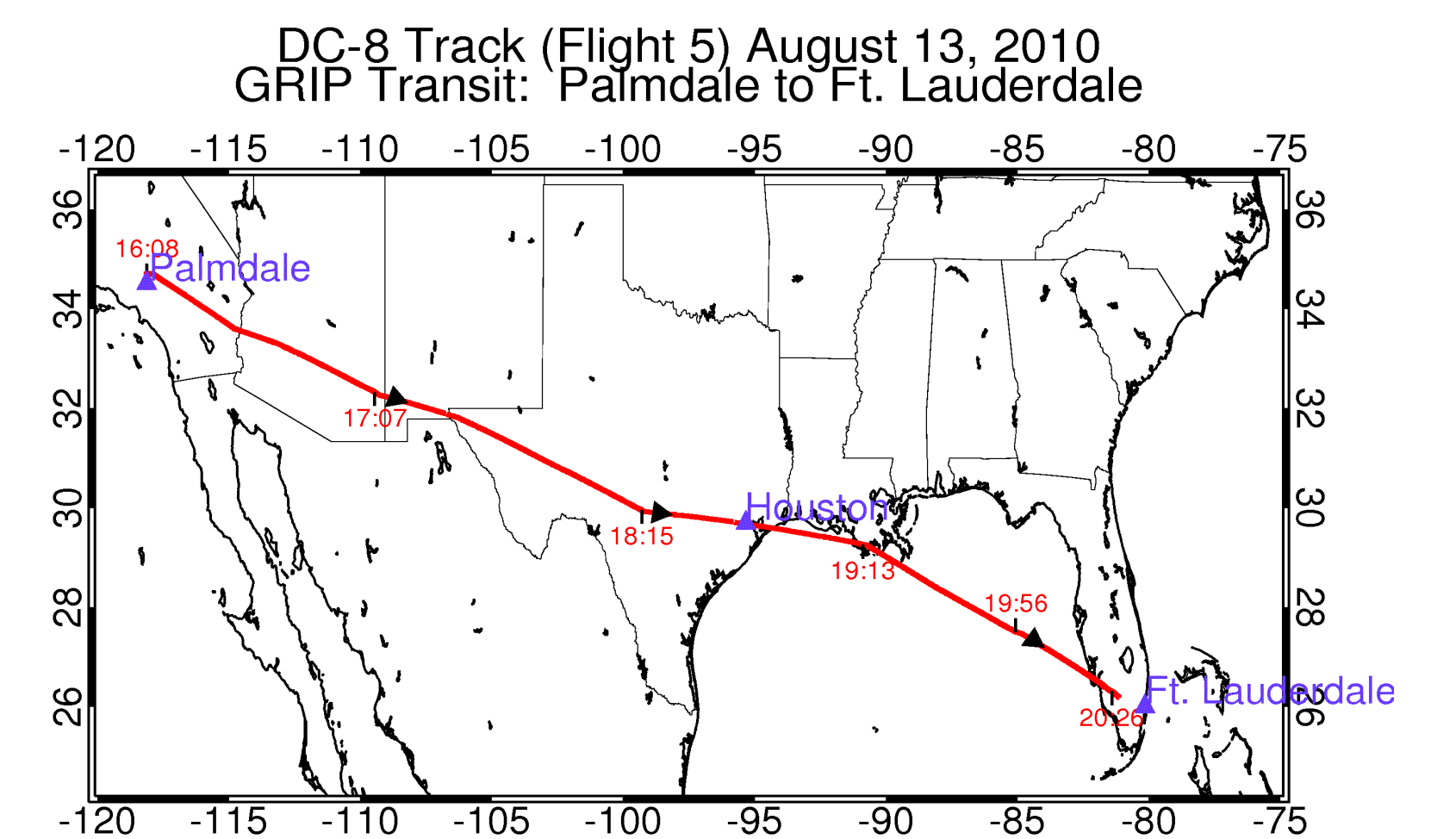
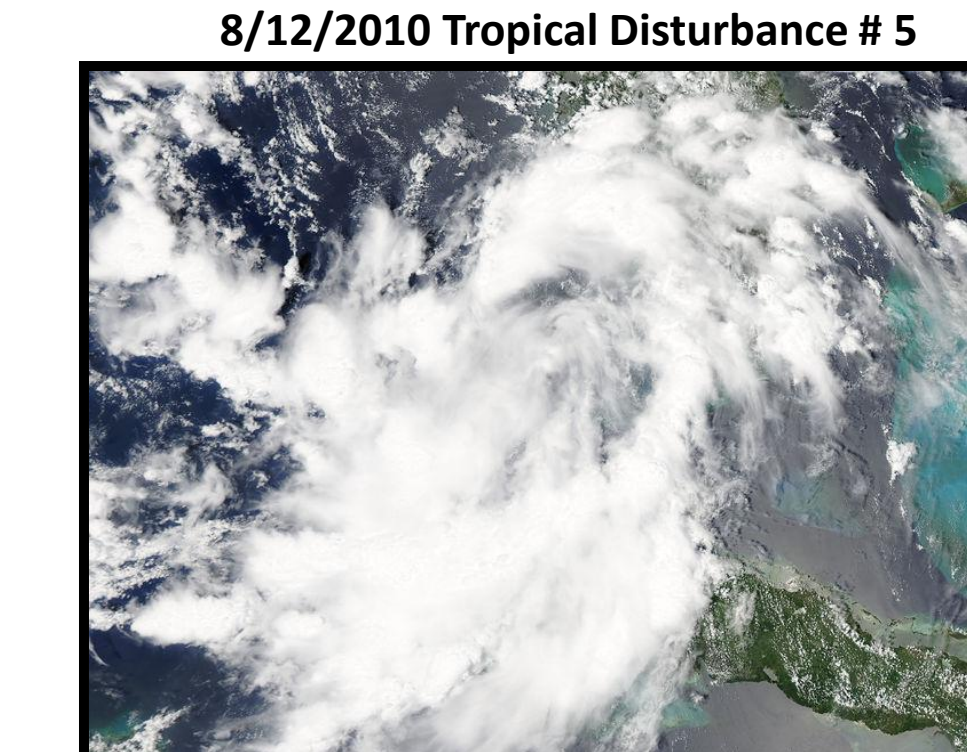
Susan Kooi<sup>1</sup>, Syed Ismail<sup>2</sup>, Richard Ferrare<sup>2</sup>, Johnathan Hair<sup>2</sup>, Anthony Notari<sup>2</sup>, Marta Fenn<sup>1</sup>, Carolyn Butler<sup>1</sup>, Amin Nehrir<sup>3</sup>, James Collins<sup>1</sup>,  
Dave Harper<sup>2</sup>, Tamer Refaat<sup>4</sup>, and Jeff Halverson<sup>5</sup>

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<sup>4</sup>Old Dominion University, Norfolk, VA, USA, <sup>5</sup>Univeristy of Maryland Baltimore Campus, Baltimore, Maryland, USA



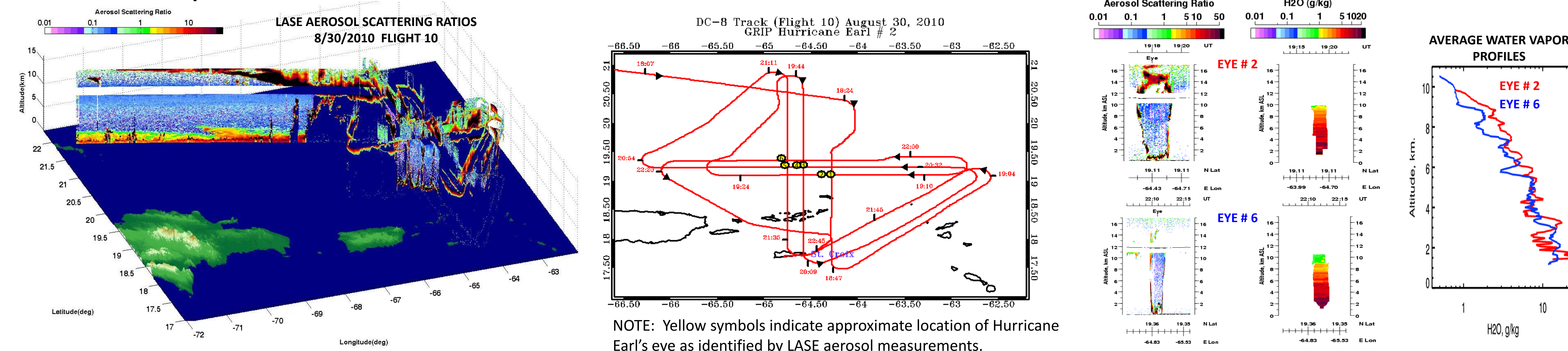
## Flight 5 / Palmdale to Ft. Lauderdale/ August 13, 2010 Gulf storm outflow

- LASE observed an increase in water vapor and low level aerosols over the Gulf of Mexico.
- Long-range measurements of water vapor, aerosol, and cloud distributions over mid-latitude and tropical air masses and TD#5
- LASE observed cirrus outflow associated with Tropical Disturbance # 5



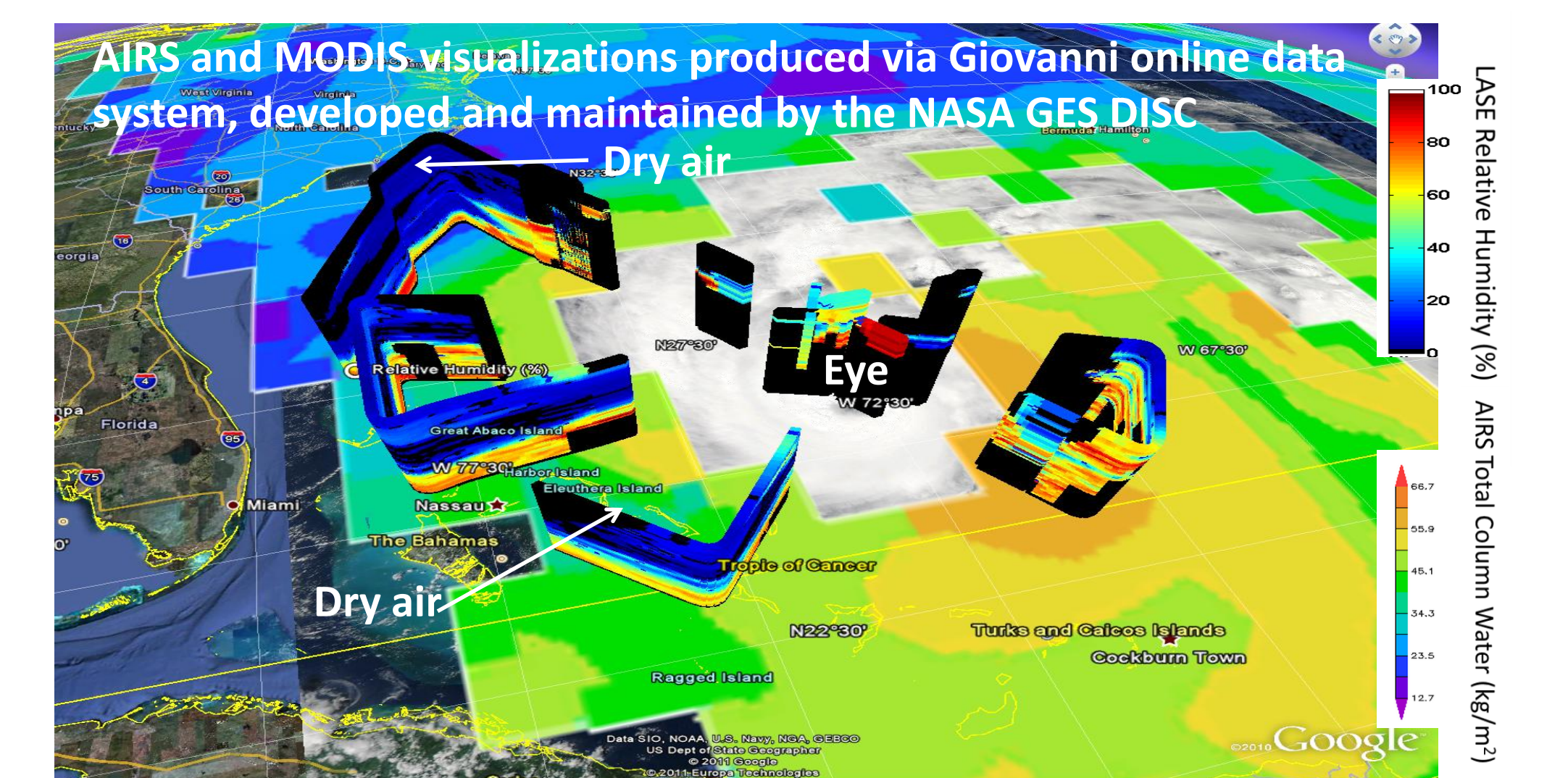
## Flight 10 / Hurricane Earl Day #2 / August 30, 2010 Eye wall evolution during rapid intensification

- LASE measures water vapor and aerosols almost to the surface in the well defined eye of Earl
- LASE aerosol measurements show the width and depth of the eye
- LASE measurements show the evolution of the eye during 6 passes over a 4 hour time period
- Aerosols indicate a broader eye at the top with clouds above on the 2<sup>nd</sup> pass and a nearly constant width with clear skies above on the 6<sup>th</sup> pass when Earl had intensified.
- Water vapor was nearly the same on both passes below 5 km but drier above on the last pass



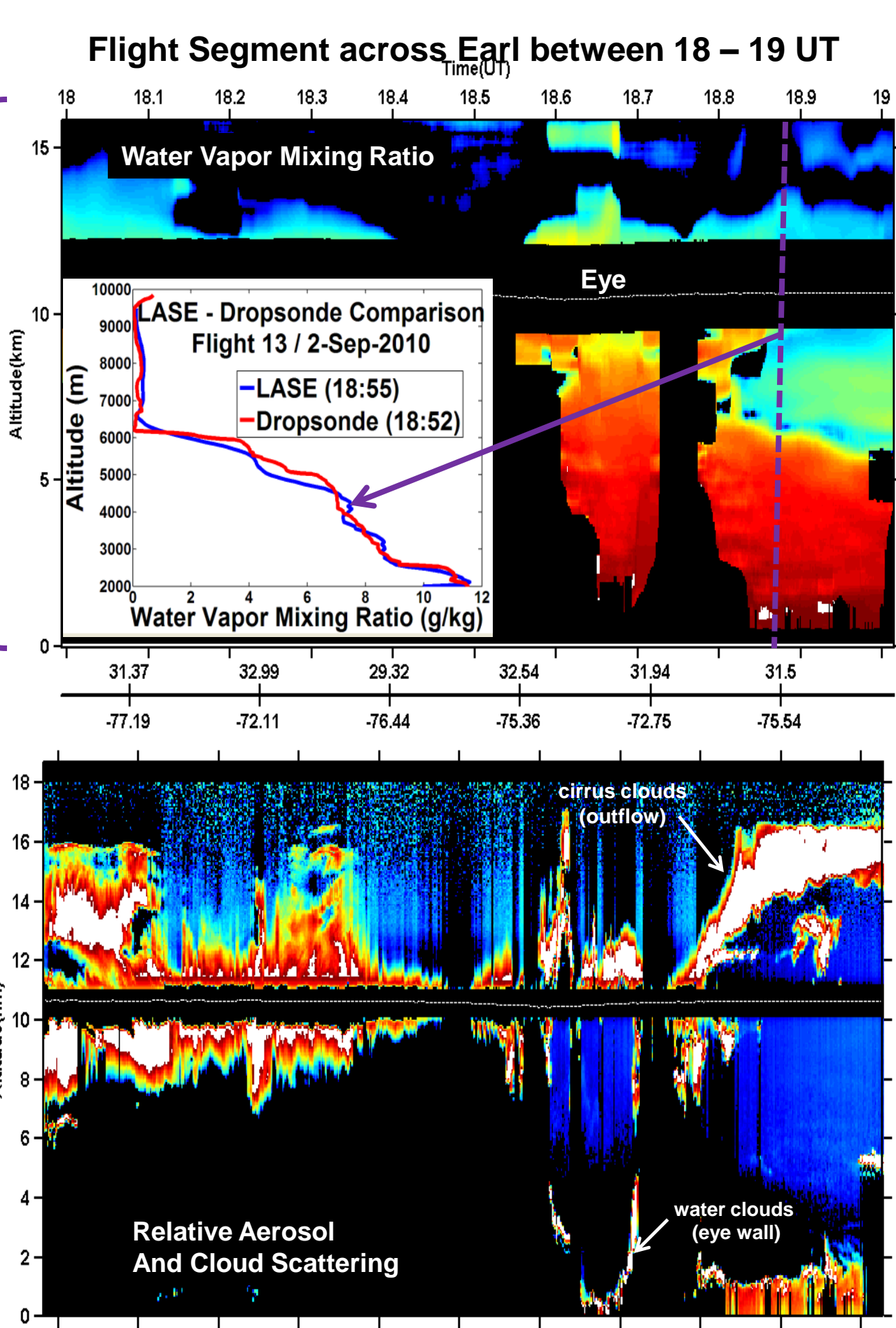
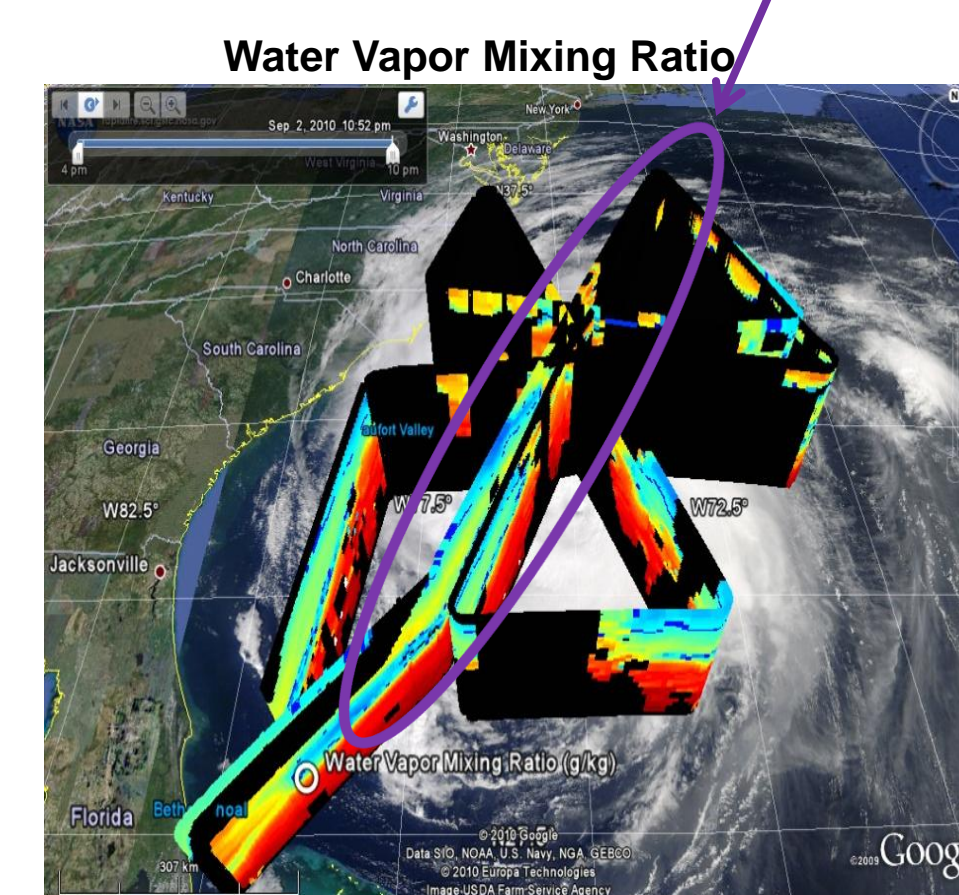
## Flight 12 / Hurricane Earl #3/ September 1, 2010 LASE measurements of moisture in and around the storm

- Composite image of RH derived from LASE and dropsondes, TPW from AIRS on Aqua, and Aqua MODIS clouds in the visible channel showing Hurricane Earl.
- Dry air in the NW, West, and SW regions
- Very moist air in and near the eye, and the SE
- Generally moist region in the East
- Qualitative agreement between LASE and AIRS moisture measurements



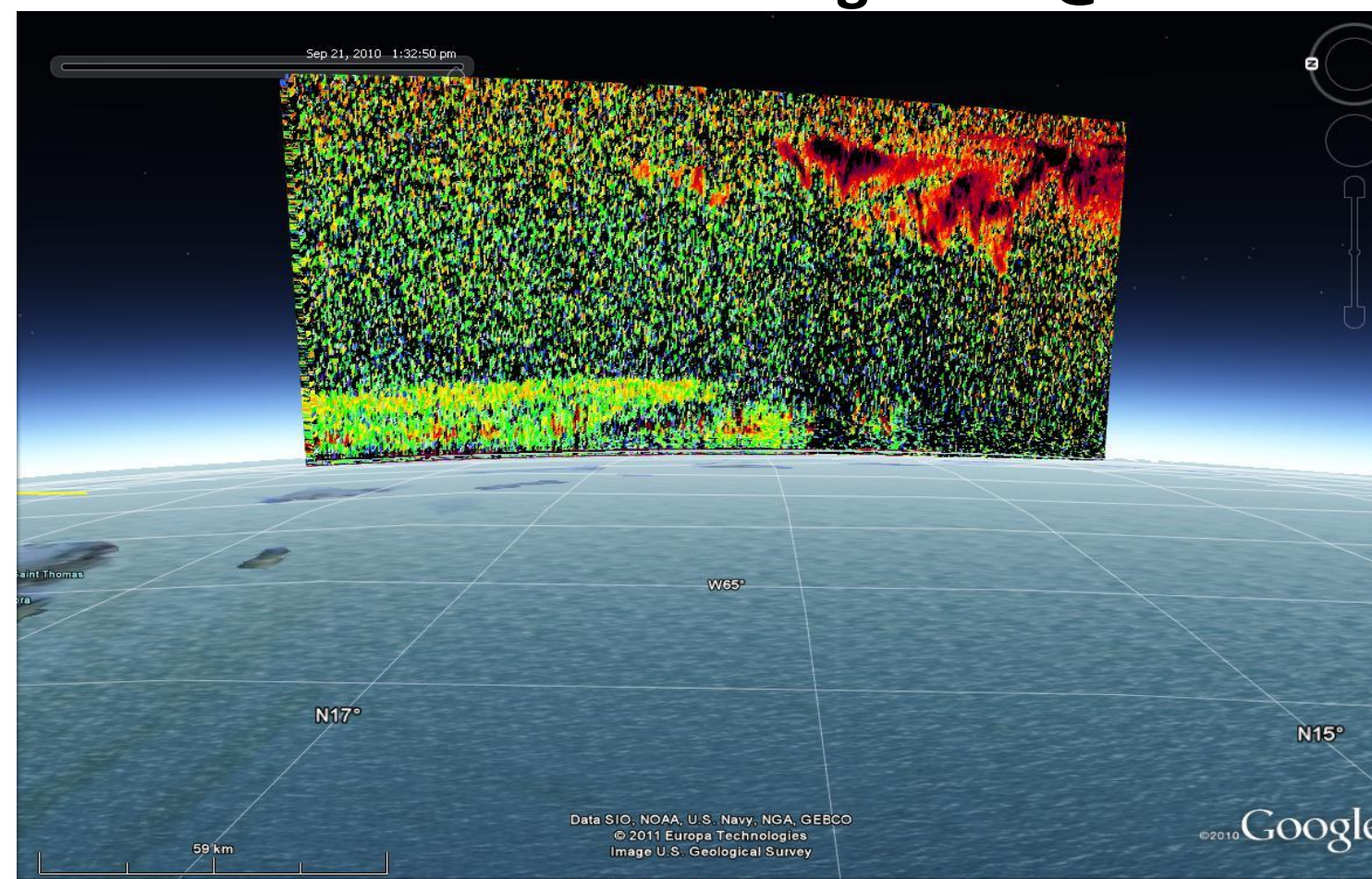
## Flight 13 / Hurricane Earl #4/ September 2, 2010

- LASE measured water vapor, aerosol, and cloud distributions during flights over Hurricane Earl
- LASE and dropsonde measurements of water vapor just outside eye wall show good agreement

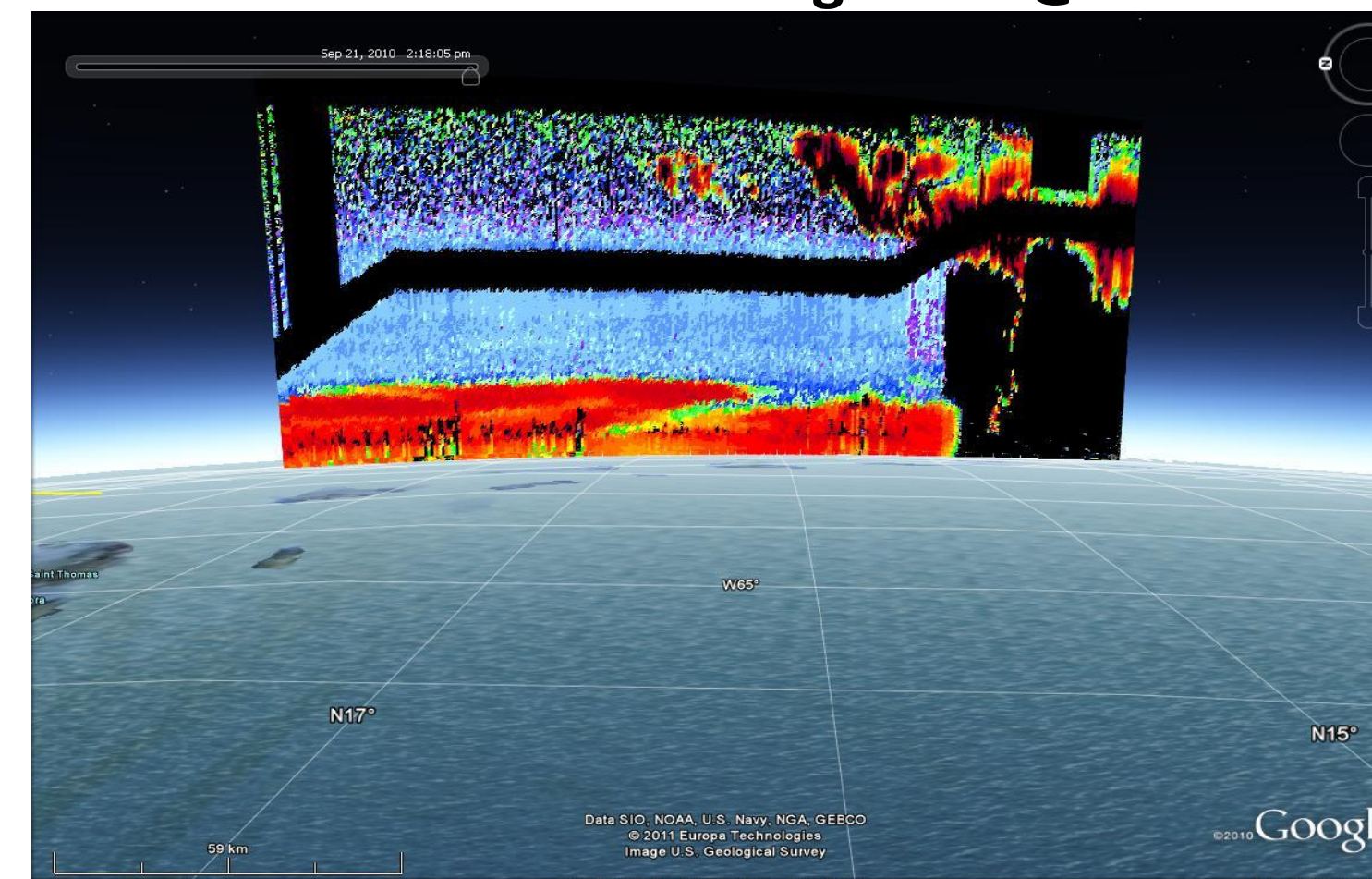


## Flight 23 / PGI-46/ September 21, 2010 CALIPSO & CLOUDSAT underpass

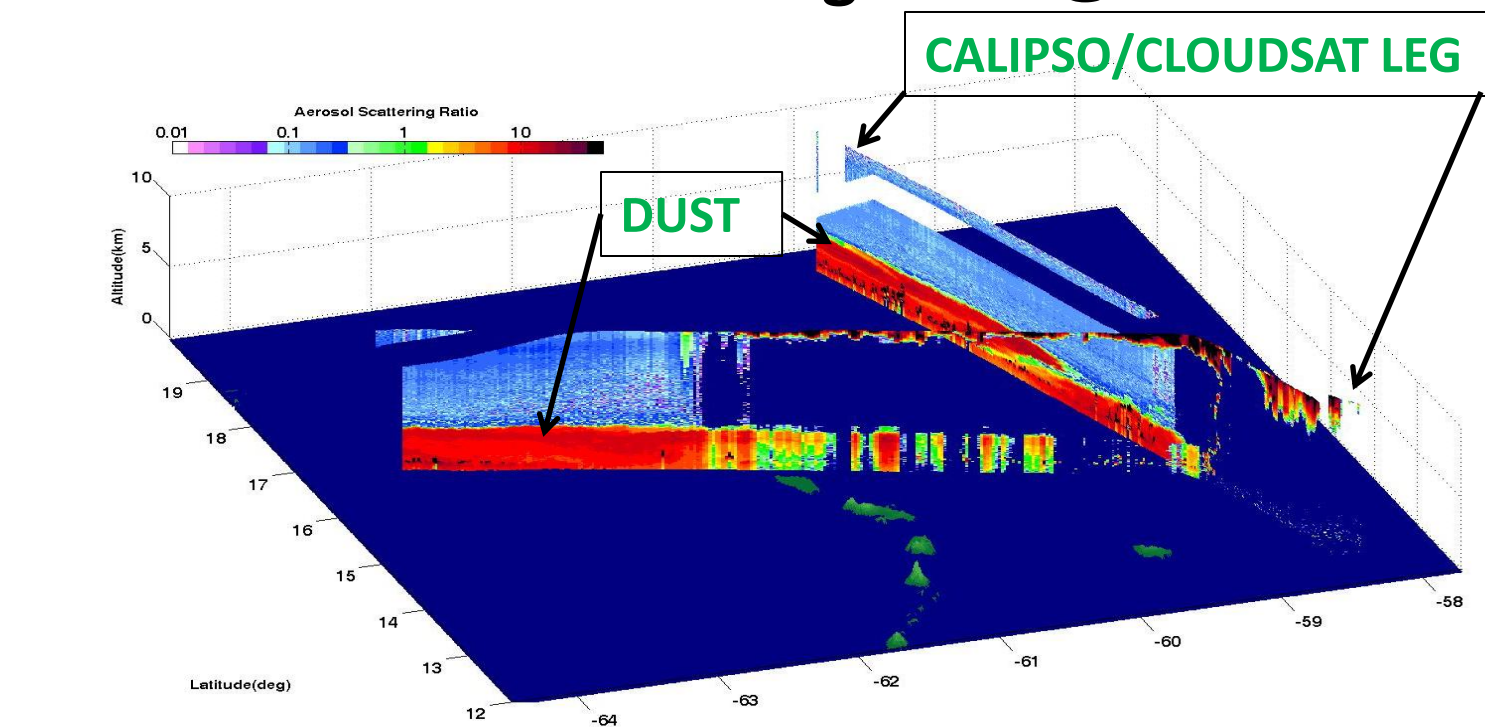
CALIPSO Aerosol Scattering Ratio @532 nm



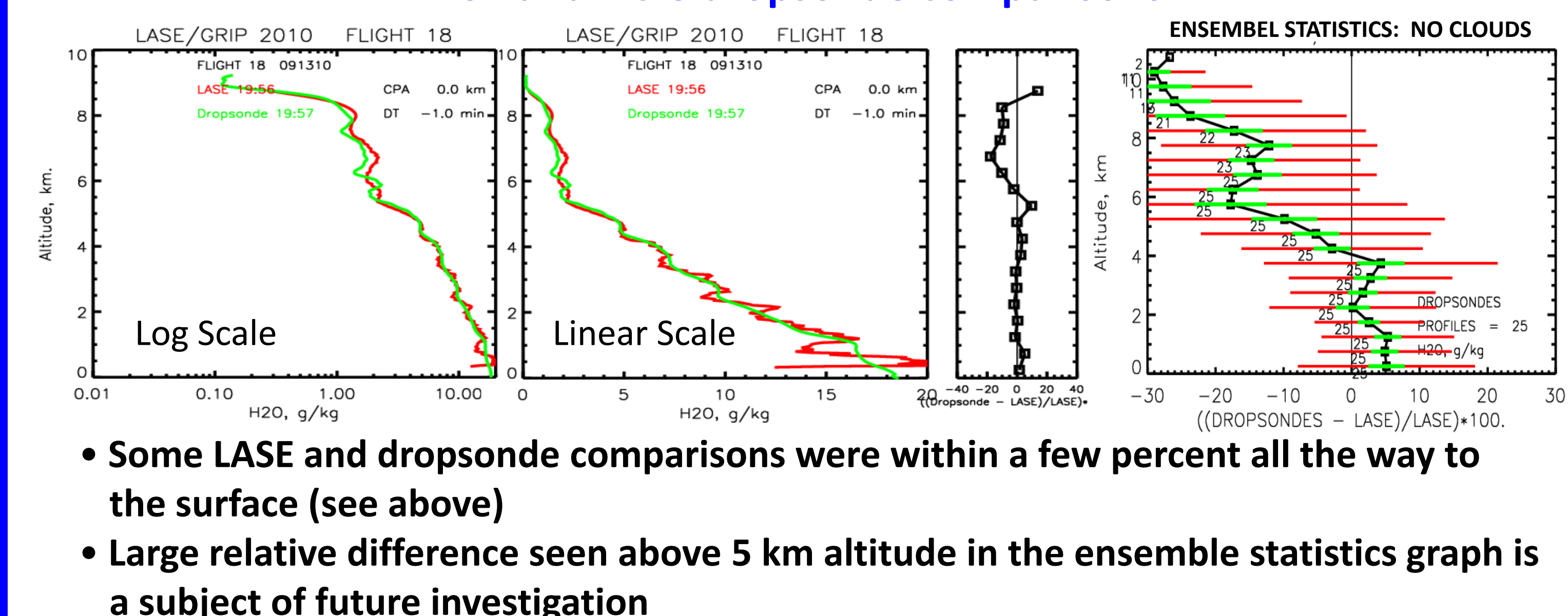
LASE Aerosol Scattering Ratio @817 nm



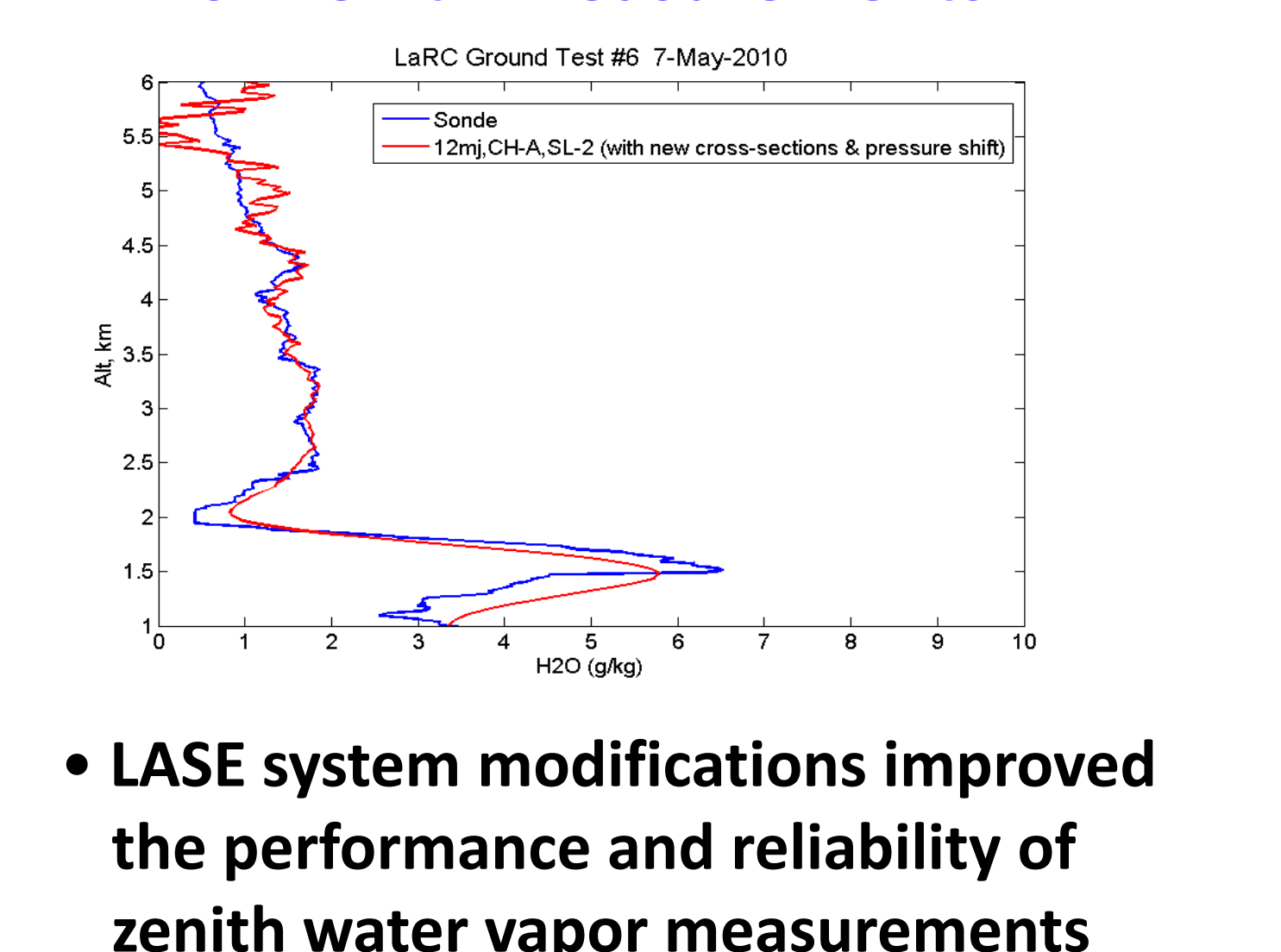
LASE Aerosol Scattering Ratio @817 nm



## LASE and DC-8 dropsonde comparisons



## LASE zenith measurements



## Summary

- LASE operated flawlessly during the GRIP mission collecting data from 20 (science and transit) flights—real-time images of water vapor mixing ratio, aerosol scattering ratio, and cloud distributions were made available on the DC-8.
- Post-processed LASE water vapor mixing ratio, aerosol scattering ratio and water cloud distribution data (images and digital data) have been archived at the GRIP site.
- Advanced LASE data products including RH, total precipitable water (TPW), aerosol extinction and scattering coefficient profiles, and aerosol optical depth will be derived on a case by case basis and on request.
- LASE data will be used in addressing GRIP science objectives (viz. to study intensification processes) by providing information on large scale environment, dry air intrusions, SAL, convection, and cloud distributions.
- Initiated analysis to study: evolution of the eye of Hurricane Earl; dry air intrusions on Earl; comparisons with satellite data from AIRS, MODIS, and CALIPSO.
- LASE measurements were used to compare with water vapor profiles from new dropsondes from the DC-8.
- LASE aerosol measurements can be used to compare with in situ observations and model predictions.

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